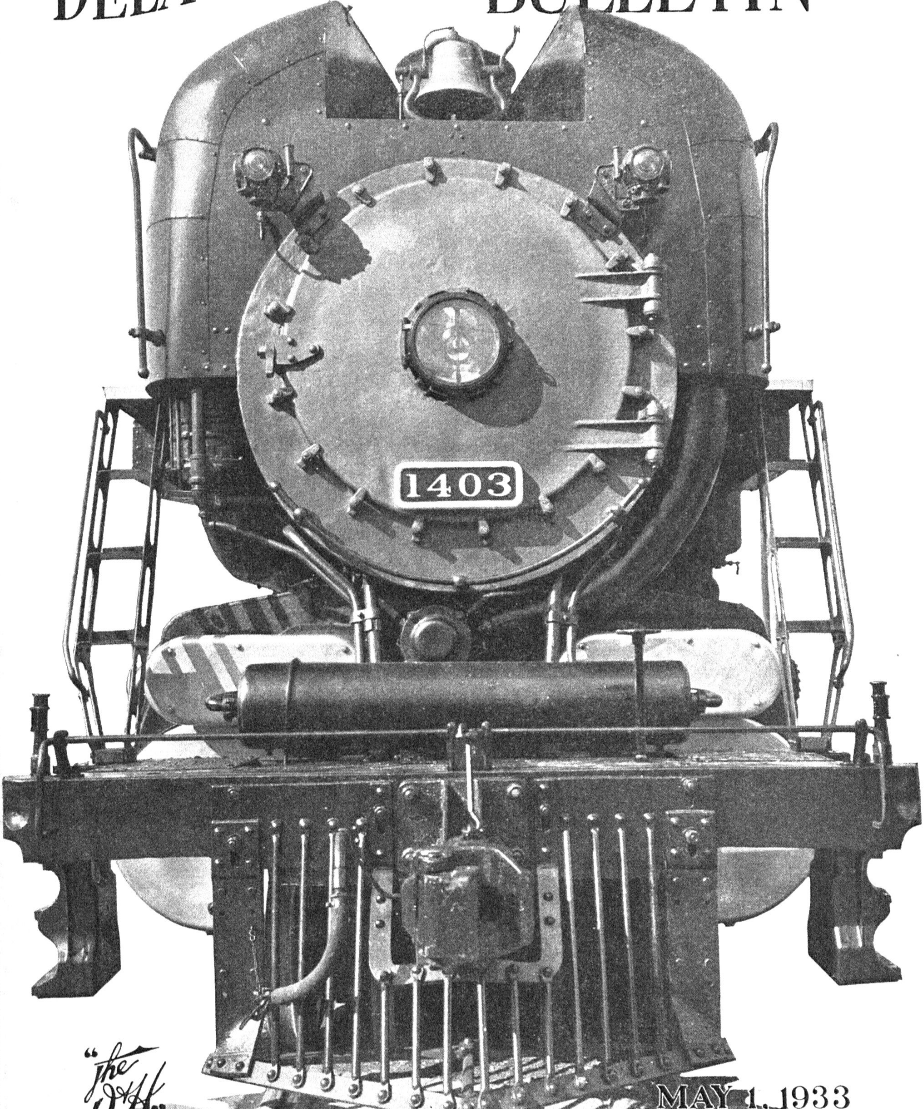
THE DELAWARE AND HUDSON RAILROAD BULLETIN



"the D&H"

MAY 1, 1933

In the Cab

YOU may talk of the wild thrill in flying
Through the great upper reaches of air!
Of the bird-man's sensations in trying
To rival the eagle up there!
But I'd rather be here at the throttle
Of a big locomotive, and feel
The throb of her engine, than plot all
The sky-lanes that clouds may conceal!

You may rant of the pilot's keen pleasure
As he stands at the wheel of his craft;
And guides the big boat with its treasure,
And boasts of its speed and its draught!
But I'd rather—a thousand times rather—
Be here in my cab on the rails;
Hand ready to throttle or lever,
A-thundering down the steel trails!

You may tell of the fun there is driving
A twin-six on roads as smooth as glass;
Of the sport that is yours when you're striving
Some record of speed to surpass!
But give me the huge "iron horse," and
The run on the bright, shining track!
Come, rap on 'er boys! Come across, and
We'll show 'em what's "ballin' the jack!"

—CLARENCE MANSFIELD LINDSAY.

"the D&H" *The* DELAWARE AND HUDSON RAILROAD "the D&H"
CORPORATION
BULLETIN

Replete With Thrills

Was the Life of a Train Dispatcher in the "Gay Nineties"

MANLEY J. HAGADORN

PUT yourself in the position of dispatcher MANLEY J. HAGADORN one morning back in the early 90's. A flash comes over the wire that a car, loaded with stone, has gotten away out onto the main line at the Tunnel, and is careening down the hill in the direction of Binghamton! Passenger train No. 2 has left Binghamton for Albany carrying signals for the pay car, with Paymaster S. C. Ward on board, which is following close behind. All the elements of a major disaster are at hand.

The dispatcher's wire fairly sizzles as he rouses the operators at Port Crane and Sanitaria Springs and informs them of the situation. Both men are out on the run to set switches and signals so that the two trains are put in to clear and the wild car roars past down the main line. Meanwhile the dispatcher calls Yardmaster "Pat" Shea at Binghamton and a switch is set to head the runaway into a string of empty cars. Fortunately, it is pretty well "run out" by this time and it does little damage.

This is but one of MR. HAGADORN'S recollections of nearly a half century of railroading, all with one company, the Delaware and Hudson. Like so many of the boys of his day, MANLEY was born on a farm, in Broome Center, N. Y., April 29, 1867, and received his early education in the rural school where he took his turn with the other boys at chopping wood and building the fire.

Under the instruction of Jesse H. Owens, operator at Duanesburg Junction, where the "Schenectady Branch" joined the main line from Albany to Binghamton, the boy learned telegraphy during the winter of 1883-4. The next fall he entered Delaware and Hudson service as relief operator at Delanson. As time passed he moved along the road until he worked at practically every station on the Susquehanna Division at one time or another.

One of the best "breaks" MR. HAGADORN ever got came at the time of the blizzard of 1888. Many are the railroaders who were marooned for days on trains or at far away points. Fortunately for MR. HAGADORN, he had gone to visit his fiancee, and the deep snow made it impossible for him to get back to work for two days. There was little that an operator could do during that time as there were no trains moving and few wires working.

In 1890 he became train dispatcher in the superintendent's office in Albany, where he remained until 1907. It was while he was there that he received word that a freight train had started from Delanson down the Schenectady branch. Almost immediately afterward, the operator at Duanesburg, three miles below, reported the train passing his station at a mile-a-minute clip with all the engine wheels afire. Obviously the train was out of control. A fast freight had already left Schenectady for Duanesburg and this was before the days of the double track on that portion of the line. Fortunately the dispatcher was able to raise an operator who side-tracked the fast freight and the runaway dropped down into the "sag" between Kelly's and South Schenectady where it was stopped without injury. The wreckers had to be called to reset the locomotive tires, all of which had been loosened by the terrific heat from the brake shoes as the engineer tried to control the headlong flight of his train.

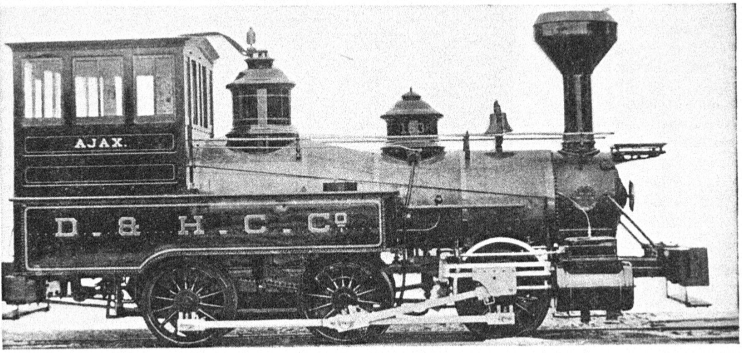
A slight paralysis of his hand in 1907 interfered with his handling of telegraphic messages and he was forced to give up dispatching. Just at this time the first examination car was put out on the line and MR. HAGADORN was put in charge of the tests for color perception, eye-sight and hearing. Later the examinations became more thorough and a physician was put in charge of the work.

MR. HAGADORN was then transferred to the Commissary Department under J. T. McKee, Superintendent of Dining Service, and soon he went to Plattsburg as commissary agent. At that time the department maintained a large storehouse there from which supplies of canned goods and all sorts of foods and liquors were shipped. The boats on both Lake Champlain and Lake George were stocked from Plattsburg as was the comparatively small storeroom at Albany for the dining car supplies. Plattsburg also shipped to Lyon Mountain whatever might be needed by the Hotel Chateaugay. Although not officially supplying the Hotel Champlain, MR. HAGADORN recalls many occasions when he helped them out of difficulties in obtaining necessary articles.

Following the closing of the Plattsburg commissary storehouse MR. HAGADORN came back to Albany as manager of the Colonie restaurant. He continued in the Commissary Department as relief steward and in charge of the storeroom until his retirement on October 1, 1932.

MR. HAGADORN resides with his wife, his son J. Stuart Hagadorn, and his daughter, Mrs. W. P. Webb, at 225 North Pearl Street, Albany.

AJAX—"Mighty One" of the 80's



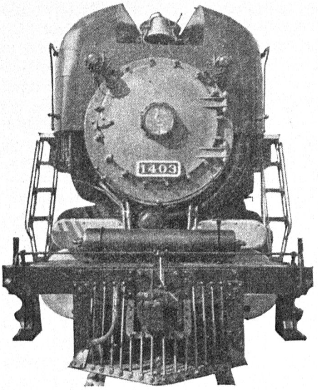
Better Never Than Late!

A man saw a message and an address on an egg he got for breakfast. The message read:

"This egg was packed by a girl thousands of miles from the United States. She is supposed to be the prettiest girl in this neighborhood, and is prepared to marry the man who eats this egg."

The man cabled her, "I'll marry you."

The girl's reply read: "I am flattered by your proposal, but I am now married and have three children."



First in the World!

Delaware and Hudson Locomotive No. 1403, Four-cylinder, Triple-expansion, Non-articulated Compound, with Poppet Valves, has Hauling Capacity of a Mallet.

POSSESSED of the "brute strength" of a Mallet, yet with a modest appetite for coal and water, Delaware and Hudson locomotive No. 1403 stands forth as "something new under the sun." Named *L. F. Loree,* in honor of the man whose faith in the future of steam railroads has never been shaken and whose interest in locomotive development has made its construction possible, the 1403 is the first and only four-cylinder, triple-expansion, non-articulated compound steam locomotive in the world.

To the railroader that description is quite clear but, for the sake of the other readers of *The Bulletin,* this means that:

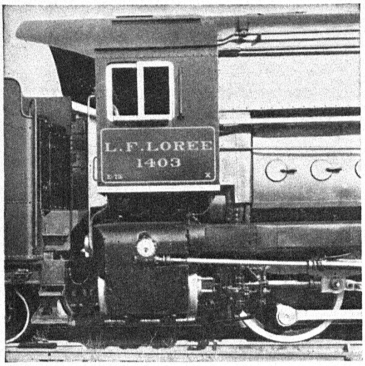
1. The locomotive has four cylinders instead of the usual two. The use of this number of cylinders is not, of itself, a new feature as our 1500-and 1600-class Mallets all have four cylinders. On those classes, as on other locomotives of similar design, the rigid wheel base is divided into two sections connected by a flexible joint, each pair of cylinders operating in connection with a separate set of three or four pairs of driving wheels. In other words, two separate engines connected by a joint, hence called "articulated."

The 1403 has four cylinders, one of which is located at each corner of the machine, the pairs on either side being connected through individual pistons, crossheads and driving rods, to a single main crank-pin. Alloy steels are used throughout the entire locomotive to provide additional strength without increased weight.

2. Steam at 500 pounds per square inch pressure passes from the boiler through a superheater and thence through the throttle valve and a specially designed steam pipe, to the high pressure cylinder, located below the cab on the right side. This pipe is corrugated to allow for expansion and contraction with the changes in temperature to which it is exposed. After having expanded and pushed the piston through the length of the cylinder, the steam then passes to the intermediate pressure cylinder which is below the cab on the lef side. Again the same steam that moved the high-pressure piston now propels the intermediate piston as the steam expands a second time while doing more work. By this time the pressure has been so much reduced that the quantity of steam which was needed to drive the twenty-inch high-pressure piston fills the *two* 33-inch low-pressure cylinders. Following this third expansion, from which the "triple expansion" designation is derived, the steam is exhausted up the smoke stack at a pressure of 3 to 5 pounds above that of the atmosphere, as compared with 7 to 10 for older types of power.

3. Following the practice of the Delaware and Hudson designers of earlier experimental freight power the consolidation type of wheel arrangement would have been followed, in order to have the greatest possible proportion of the weight on the driving wheels, but for the fact that the two large low-pressure cylinders at the front were too heavy to be carried on a single lead truck axle. Consequently, a 4-8-0 arrangement was utilized. Thus the 1403, although as powerful as a Mallet with 16 drivers, has only eight.

Before steam can be used efficiently it is essential that it be generated economically. It is for this reason that the boiler pressure has been progressively increased in the Delaware and Hudson's experimental locomotives. The *Horatio Allen* carries 350 pounds as compared with the usual 225 to 250, while in the 1401 this was increased to 400 pounds and the 1402 and 1403 carry 500 pounds pressure. This is generated in a boiler having a water tube firebox,



High Pressure Cylinder Under Cab. Injector just ahead of cylinder

vertical tubes, the top and bottom ends of which enter steel drums, forming the sides of the firebox.

In the construction of the 1403 these drums are seamless forgings which are machined eccentric so that one portion of the wall is left thicker than the rest. In this thick portion are drilled the holes through which the tubes enter the drums, extra material thus being provided to increase the strength of the "bridges" between the adjacent holes. Following standard Delaware and Hudson practice the firebox is of the wide type, extending out over the rear drivers. The grate area, less than 80 square feet in a locomotive of this power, is an indication of the degree of efficiency at which the machine is expected to operate.

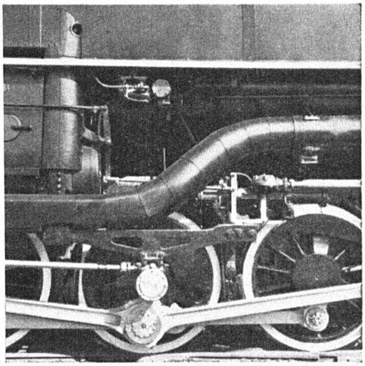
At the present time the thermal efficiency of an ordinary locomotive is about 5½ to 6 per cent, that is, only that proportion of the energy present in the coal that is fed into the firebox is transformed into power at the drawbar for pulling a train. Theoretically it is possible to increase this figure to 17 or 18 per cent. To approach more nearly this degree of efficiency is the goal of the Delaware and Hudson management, and the reason for its continued experimentation along these lines.

In 1924, at the dedication of the *Horatio Allen*, No. 1400, President Loree expressed the hope that that locomotive would "develop one-third more haulage capacity, with one-third less consumption of fuel and water, than the corresponding Consolidation locomotive." This hope was realized and the 1403 is expected to continue this improvement along these lines.

One of the major features of the locomotive is the valve mechanism. From the experience had with poppet valves on locomotives 925 and 651, it was decided to apply the same type of valve to the 1403. The poppet valves on both locomotives previously equipped were actuated by Walschaert motion and oscillating camshafts, while in the design of the 1403 a rotary cam gear is employed. This arrangement lends itself most efficiently to the triple expansion requirements, in the correlating of the movements of the valves of the four cylinders.

The rotary drive is obtained by means of cranks secured to the main pins which to all appearances are the familiar eccentric cranks of the Walschaert gear, but as applied to the 1403 the free end of each crank is set exactly in line with the center of the main axle, thereby producing the rotary motion necessary for the valve cam shaft operation. The valves of the high-pressure and intermediate pressure cylinders are actuated from the right main crank pin, while the left main crank pin controls the movements of the valves for the two low-pressure cylinders. In this manner all the valves are primarily actuated by the rotation of a single shaft, the main axle, and each movement of the valves in the high pressure cylinder is attended by a definite predetermined movement of the valves in the other cylinders, thereby securing proper correlation of the work in the different cylinders.

Some idea of the capacity of the poppet valves may be had when their dimensions are known.



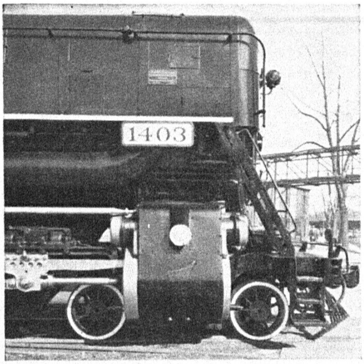
Main Driving Wheel, Showing Non-eccentric Crank and Valve Gear Drive Shaft. Above is Reverse Gear and Portion of High Pressure Steam Pipe Covered with Insulation and Jacketed.

For the high pressure cylinder both intake and exhaust valves are 9 inches in diameter with a maximum lift of one inch. The intake valve lift may be reduced to one-half inch but the minimum for the exhaust valve is three-quarters of an inch. Similarly, the intake valve of the intermediate pressure cylinder is 9 inches in diameter with an inch maximum and a half-inch minimum lift. The exhaust valve, which is 9½ inches in diameter, has lift limits of 1-1/16 and ¾ inches. For the low pressure cylinders 9½-inch intake and 9-inch exhaust valves are provided, the former having lift limits of 1-1/16 and ¾ inches, and the latter 1-inch and ¾ inch.

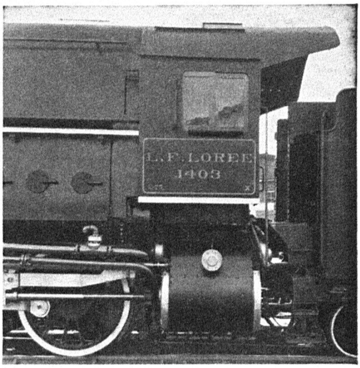
The power reverse gear is of special design and provides cutoff in forward motion—full gear, 66%, 58%, 50%, 43% and 36% as well as a drifting position, and in backward motion—full gear, 66% and 36%.

The main driving wheels are of box section design, which, in addition to being lighter in weight, are less likely to develop cracks than those of the old type. As the Delaware and Hudson was the first road to apply roller bearings to the main driving axle of a locomotive, it is significant that this type has been adopted for use on the 1403.

Another innovation is the design of the lead truck, journal boxes and side frames of which are cast integral to effect a considerable saving in weight. Lubrication of the wheel bearings is done through handholes in the pedestal legs at the front and rear of the truck, it being unnecessary to remove any bolts or keys to get at the bearings. The journals are 7½ by 13 inches and the oil cellars come up as high as the center of the axle at the rear while the front edge has a protruding lip to insure the retention of waste and oil in their proper places. Additional features of the truck are its 56-inch springs and the lateral resistance device, both of which should improve the riding qualities of the locomotive.



One of the two Low Pressure Cylinders. Special Guide Bar Mountings are used to Allow for Expansion and Contraction. Air Compressor concealed by jacket, as is smokestack.



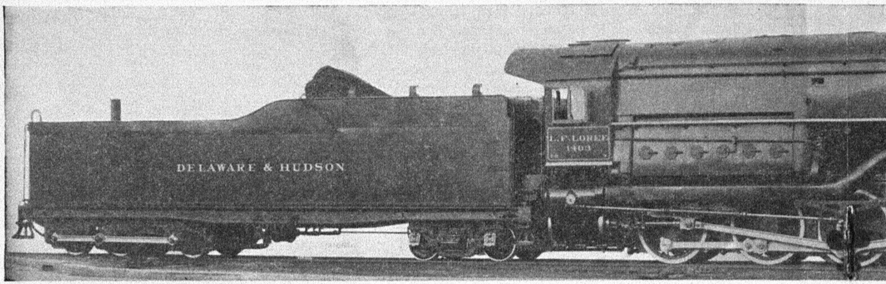
Intermediate Pressure Cylinder. Note simplicity of valve gear

In conformity with the Delaware and Hudson practice of concealing the piping and various auxiliary units beneath the jacket of the boiler, even the air compressor of the 1403 is hidden, although mounted on the right side of the smoke box. Radiating fins applied to the air pipe to the main reservoir facilitate the cooling of the compressed air to such an extent that only half as much pipe is used here as would normally be required.

Mounted below the left running board is the Dabeg mechanical feed water heater pump, driven from the crosshead, which supplies the boiler. A specially designed injector, which will operate against any pressure of steam from 100 to 500 pounds, is mounted below the cab on the right side as an auxiliary water supply.

Lubrication is supplied by a 26-feed mechanical lubricator, supplemented by a hydrostatic lubricator which supplies the water- and air-pumps and other auxiliaries.

To fully appreciate the hugeness of the 1403, the excellent proportions of which fail to give a real impression of its size, it is necessary to enter

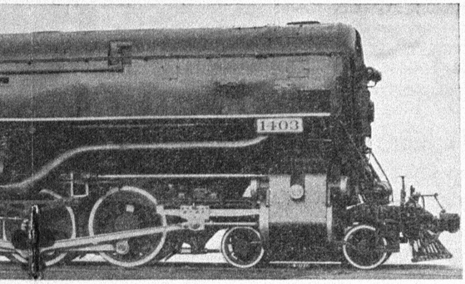


the cab. In proportion to the rest of the locomotive it seems so small that it is quite surprising to enter a "room" about seven feet square, and, with the exception of the comfortable seats of the crew, practically devoid of the usual paraphernalia that clutters up the "standing room." Even the pedals that control the operation of the fire-door are set into the floor conveniently near the fireman's station.

Beyond the addition of a pyrometer and a 1000 lb. steam gauge or two for determining the condition of the steam at various points in its travels through the machine, the controls are similar to those on the usual locomotive. Pneumatic operation of sanders, cylinder-cocks, bell-ringer, whistle, etc., is in accordance with standard practice. Only the fact that the boiler butt does not extend back into the cab at all and the three ventilators in the cab roof and two more in the rear are reminders of the care that has been taken to assure comfort for the crew despite the high temperatures within the machine.

The capacity of the long, low tender, designed to avoid side sway at high speeds, is a further indication of the expected efficiency of the locomotive. It carries 14,000 gallons of water and 17.5 tons of coal, which, while in themselves goodly amounts, are but two-thirds of what would be provided for the conventional locomotive operating in the same service. The tender acts not only as a carrier of coal and water but as a second locomotive, its capacity being as great as that of the motive power of half a century ago. The rear truck is a Bethlehem Auxiliary Locomotive in which a pair of cylinders, using 500-pound steam direct from the boiler, drives, through gears and rods, the three axles of the truck. At starting or at speeds under 10 miles per hour this arrangement adds 18,000 pounds to the 75,000 tractive effort of the locomotive when operated as a compound. By introducing high pressure steam into all of the four cylinders of the locomotive its tractive effort may be increased to 90,000 pounds. This, with the additional power of the booster, gives a total force of 108,000 pounds, which is only equaled by the heavy Mallets.

The total loaded weight of the locomotive and tender is 669,000 pounds. Of this the locomotive, with 69,000 pounds on the engine truck and 313,000 on the 63-inch diameter driving wheels, totals 382,000, while the tender, full of coal and water, weighs 287,000. The efficiency of the 1403 is once more apparent when it is considered that many less powerful locomotives of the con-



ventional design weigh, without tenders, as much as 400,000 pounds, of which only about 275,000 is available for holding the driving wheels down on the rails for the purpose of transmitting power.

For ready reference a tabulation of some of the principal data descriptive of the locomotive follows:

Type	4-8-0
Wt. on Engine Truck, lbs	69,000
Wt. on Drivers	313,000
Wt., Total	382,000
Wt. Tender, light	125,300
Wt. Tender, 2/3 loaded	226,400
Wt. Eng. and Tender	608,400
Steam Pressure, lbs.	500
Steam Pressure, Aux. Loco.	500
Tractive Power, Simple, lbs.	90,000
Tractive Power, Compound	75,000
Tractive Power, Aux. Loco.	18,000
Water Tubes	260-2½" O. D. 6-3" O. D.
Flues	155—2" 52—5½"
Firebox, Length, in.	140
Firebox, Width, in.	77¾
Brick Arch	Yes
Combustion Chamber	None
Heating Surface, Flues & Tubes, sq. ft.	2325
Heating Surface, Arch Tubes	61
Heating Surface, Firebox	965
Evap. Heat, Surf., Total	3351
Combined Heat. Surf.	4427
Heat. Surf. Superheater	1076
Grate Area, sq. ft.	75.8
Fuel	Bituminous Coal
Frame Centers, inches	39
Cylinder Centers	93
Cylinder Dimensions, inches:	
High Pressure	20 x 32
Intermediate	27½ x 32
Low (2)	33 x 32
Auxiliary Locomotive (2)	8½ x 10
Length of Main Rods, F. & B., in.	132
Driving Wheel Base	18 ft. 10 in.
Engine Wheel Base	33 ft. 9 in.
Length Overall	95 ft. 5 in.
Height above rail	15 ft. 7½ in.

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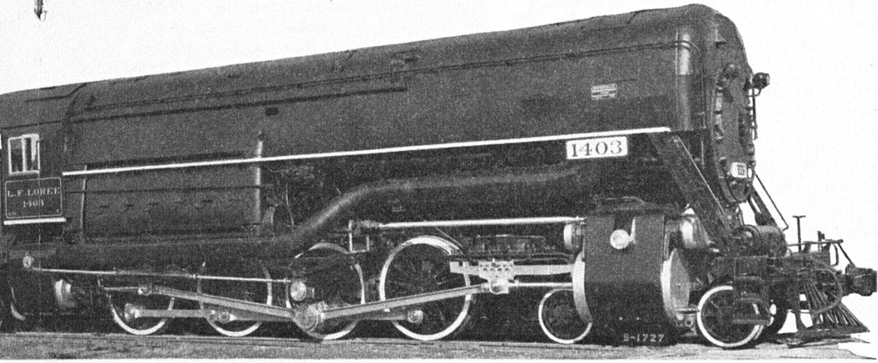

The
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BULLETIN

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Vol. 13 **May 1, 1933** **No. 5**

Still Pioneering

ONCE more the Delaware and Hudson has expressed its faith in the superior advantages of the independent unit system of transportation as opposed to the "rope haulage" idea, though the latter was the original method of operation on the Gravity Railroad. As was pointed out by PRESIDENT LOREE at the christening of the *Horatio Allen*, Delaware and Hudson locomotive No. 1400, in 1924, the electric car or locomotive which depends on a central power station for its motivating force is, in essence, a type of rope haulage, the wires which conduct the electrical energy taking the place of the moving ropes of the cable railways.

It is generally conceded that one principal advantage of electrification is the degree of efficiency with which stationary boilers and turbine-driven generators can produce energy. Handicapped by rigid restrictions as to weight and size, as well as being forced to meet limitations imposed by operation while rocking along at from 50 to 70 miles an hour, and a multitude of other factors that are not considered in stationary practice, the designers of Delaware and Hudson locomotive No. 1403 have dared to venture far in advance of tradition.

Due to the several unusual features, each of which has been previously tried in service independently of the rest but never in such a combination, it is anticipated that the new locomotive will operate at an overall efficiency higher than any previously attained in this country, including electric motive power.

Thus, as was the case when the *Stourbridge Lion* made history 104 years ago, the Delaware and Hudson continues to pioneer.

Machines and Men

WHAT is the reaction of the average railroad employee as he reads of the ability of the *L. F. Loree* and its sister super-locomotives to handle increased tonnage with great ease and efficiency? Perhaps it is one of resentment and fear for what the future may have in store for him as an individual. We are passing through what everyone knows is a subnormal period. Fantastic suggestions for improving conditions are advanced on every hand. A lot of straight thinking is necessary to see things in proper relation to each other.

Mass production, as we know it, has existed only since the turn of the century. Its most rapid strides have been made in the past decade. Labor saving machinery has thrown thousands out of work and yet, according to the reports of the American Federation of Labor and the United States census, 39.7% of the population over 10 years of age was gainfully employed in 1930 as against 39.5% in 1900, notwithstanding an increase of 46 million in the population in that period.

Between 1919 and 1928 increased machine efficiency threw 1,957,000 people out of employment. Meanwhile new trades, professions and industries gave work to 2,527,000 directly, and to 2,000,000 more indirectly.

No one dreamed of the automobile, radio, electric-refrigeration, air-conditioning, or the present and probably transient jig-saw puzzle industry now doing an annual business estimated at over $10,000,000, before their birth.

An employee of the United States Patent Office is said to have given up his position there in 1866, because he thought that everything worth while had been invented and there was no future in the Patent Office!

We now face two alternatives: development of new industries or shorter working periods. Since our prosperity, both individually and collectively, depends on the production of wealth in the form of usable goods or services for which others are willing to pay in goods or their equivalent, money, we must develop new industries.

Business cannot pay full-time pay for half-time work, even though machines help man to produce twice as much in a given time as he could alone.

(Concluded on page 78)

"Stourbridge Lion" Runs Again

In Replica Built for Chicago's "Century of Progress" Exposition

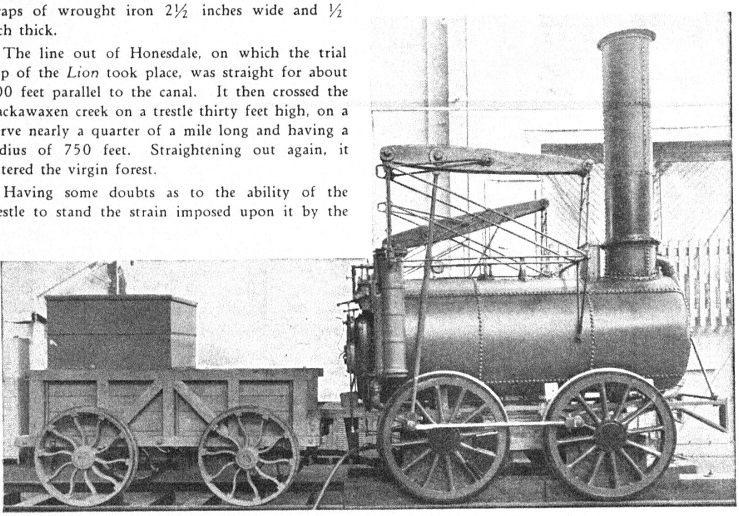
THE Century of Progress, for which the 1933 Chicago Exposition has been named, takes in the entire history of American railroading with but very little extension of its hundred-year span. Likewise it includes the period of steam locomotive operation in the Western Hemisphere, from the day when the Delaware and Hudson's *Stourbridge Lion* made its epochal trip as the first locomotive to operate on an American railroad, to the completion of the *L. F. Loree*, the world's most modern prime mover, for the same company.

Built by Foster, Rastrick and Company of Stourbridge, England, as one of a lot of locomotives ordered by this company in 1828 for operation on its new line from the anthracite fields of northeastern Pennsylvania to the canal terminus at Honesdale, Pa., the *Lion* made its first trip August 8th, 1829. Although the specifications called for a weight of 5 tons, the completed machine was found to weigh nearly 8 tons, too much for the soft hemlock stringers which served as rails to bear, although the running surface was protected by straps of wrought iron 2½ inches wide and ½ inch thick.

The line out of Honesdale, on which the trial trip of the *Lion* took place, was straight for about 600 feet parallel to the canal. It then crossed the Lackawaxen creek on a trestle thirty feet high, on a curve nearly a quarter of a mile long and having a radius of 750 feet. Straightening out again, it entered the virgin forest.

Having some doubts as to the ability of the trestle to stand the strain imposed upon it by the passage of the locomotive, Horatio Allen, who had supervised the construction and erection of the *Lion* both in England and in this country, insisted that he alone would risk the danger. With the rash courage of a man of but 27 years, Allen pulled the throttle wide open and the locomotive moved out onto the quaking trestle, rounded the curve in safety, and disappeared from view in the forest. About a mile further, at Seeleyville, a highway bridge across the line was too low to permit the passage of the *Lion's* tall smoke stack, so she retraced her "steps" and returned to Honesdale without incident.

Subsequent attempts to strengthen the track structure by the addition of hardwood strips on top of the hemlock stringer-rails failed to make it stout enough for locomotive operation, and, after a second trial on September 9th, the *Lion* was removed from the rails and stored alongside the track, a rude covering of boards protecting it but slightly from the weather. In 1849 it was moved to the



Even the irregular rivet-spacing of the original boiler has been faithfully reproduced company's shops at Carbondale. Here the boiler was put to use, and many of the other parts were adapted to other purposes. Twenty years later the boiler was superseded by one of higher power and sold for junk. Fortunately it was located in the foundry yard of Lindsay and Earl and that firm deposited it with the Smithsonian Institute in Washington, June 18, 1889. A number of other parts of the *Stourbridge Lion* have also been collected there and the locomotive has been partially reconstructed.

As a part of the Delaware and Hudson exhibit at the Chicago Century of Progress Exposition, a replica of the *Stourbridge Lion* has been built at the company's Colonie Locomotive Shops.

Drawings for the replica were prepared from data taken from blueprints of the *Agenoria,* sister locomotive of the *Stourbridge Lion,* built by the same builder in the same year, and obtained from Kensington Museum in London, as well as from a drawing of the original locomotive made under the direction of Professor Renwick of Columbia College (now University) in 1829. These, together with the actual boiler, cylinder and walking-beam now in the Smithsonian Institution in Washington, D. C., made it possible to prepare a design from which the shop forces could build the counterpart of the original locomotive.

The boiler is of the "internally fired" type, the furnace being entirely surrounded by water. The firebox is circular, about 29 inches diameter and 4 feet long. The gases are conducted to the front end of the boiler through two circular flues which are joined at the front under the stack. Ashes are removed through the fire door and conveyed to a flattened funnel, projecting downward thru the deck to drop the ashes between the rails. The locomotive is designed to burn anthracite.

The cylinders are mounted vertically at the rear of the boiler at either side. Pistons, with a 36-inch stroke, connect at their upper ends with a horizontal walking beam, no point of which is fixed in position, its forward end being attached to a vertical swinging link, so that its path of motion is quite complicated. The main driving rods are hung vertically from a point one-quarter of the way in from the rear end of the walking beams. Consequently, the *Lion* in operation resembles a gigantic grasshopper.

The driving wheels have cast iron hubs and wood spokes, except those to which the crank pins are applied, these being of iron. The fellies are also of wood. A wrought iron retaining band is shrunk on over the fellies, holding the wheel firmly together and over this is finally shrunk the wrought iron tire, having a width of 4" and being ¾" thick at the tread.

What was probably the first feed water heater in America is the tightly covered wooden box beneath the boiler and surrounding the junction of the two exhaust pipes from the cylinders with the single exhaust pipe leading to the stack. On the original, this was improvised by Horatio Allen while the locomotive was being prepared for the trial run. Cold water, conveyed from the tender thru a leather pipe, enters this box at the bottom and entirely surrounds the heated exhaust pipes. Water is then pumped from the heater to the boiler, the pump being actuated by a rod connected to a walking beam.

The boiler is equipped with two safety valves, one of the lever and weight type, the other within the casing directly in back of the stack; the reason for the latter being to provide a safety valve which could not be tampered with by the engineman.

One noticeable difference between the *Stourbridge Lion* and the modern locomotive becomes apparent when it is necessary to reverse the direction of motion. Two separate reversing devices are provided, one for the right valve and one for the left.

Built to the 4 foot 3 inch gauge of the Gravity Railroad, the *Lion* cannot operate on standard gauge track.

In building the replica all iron parts have been hand forged to duplicate the workmanship of the original and the same care has been exercised with respect to all the detail parts used in the construction in order that a true replica might obtain. In the new work, for example, the rivets have been made to accord with those of the actual boiler in the Smithsonian Institution, some of them being slightly out of line, with heads of irregular size due to hand forging.

The tender likewise has been finished to correspond with that of the regular Gravity Railroad car which was taken from service for the trial trip. The wheels of this car are of interest as they are made by casting wrought iron spokes in cast iron hubs and rims, the spokes being slightly curved to allow for contraction in cooling.

The Scotchman Won

In the smokeroom of the sleeping car the Scot had been boring everyone with tales of the great deeds he had done.

"Well, now," said an Englishman at last, "suppose you can tell us something you can't do, and, by jove, I'll undertake to do it myself."

"Thank ye," replied the Scot, "I canna pay ma railroad fare."

The "Why" of Standard Gauge

Roman Soldiers, Who Never Heard of Railroads, Set Present Track Span

HAVE you ever wondered why the standard gauge of railways should be 4 feet, 8½ inches? It is a curious figure; it does not fit in exactly with yards or feet or inches; nor has it anything to do with the metric system. Yet 4 feet, 8½ inches is the gauge of most of the world's important systems, according to a writer in the Philadelphia *Evening Bulletin*.

The question of the railway gauge has formed a puzzle for nearly a hundred years. When Stephenson was asked by the Railway Gauge Commissioners why he had adopted 4 feet, 8½ inches for his first railways, he replied that that was the gauge of most of the tram railways in the Newcastle Colliery district. But neither he nor anybody else knew why or when the old tram railways had adopted it.

Recently the true explanation has been found, and it shows that the standard gauge goes back for at least 1,800 years in England, whilst in other countries its history can be traced hundreds of years further back.

Before the coming of the steam engine, colliery wagons were hauled by horses over rails made sometimes of wood, sometimes of stone, and occasionally of metal. It was clearly an advantage for Stephenson to make his steam railways of the same gauge. The first built were for colliery work, and the old vehicles could still be used. But why was this gauge of 4 feet, 8½ inches the traditional gauge for trucks used in connection with mines found all over the north of England?

The explanation came to light during excavations of parts of the Great Wall built 1,800 years ago by the Emperor Hadrian, from the Tyne to the Solway Firth. Chariot tracks were found in many places, and when these were measured it was discovered that the distance from wheel to wheel was 4 feet, 8½ inches. And then the true explanation came to light.

The Roman army's unit of distance was the "pace," or double stride—left-right-left. The Roman mile was a thousand paces. We know its exact length, since many of their milestones remain; from this it was found that the pace is 4 feet, 8½ inches.

All Roman chariots and all military vehicles were made with a standard track of one pace, or 4 feet, 8½ inches, to facilitate the building of roads and causeways. The Romans, we know, worked lead and iron mines in the north of England, and some of their mines were still being worked in Newcastle district in Stephenson's time. For haulage they used military wagons, and, to make the passage of these easy over soft ground, they laid down tracks made with slabs of stone measuring 4 feet, 8½ inches from center to center. Similar tracks of the same width were found in Pompeii and Herculaneum.

Perhaps the most curious part of the whole story is the influence exercised by the Roman soldier's pace on the subsequent history of our railways. It almost seems as though the ghosts of those who first built the great roads of this country determined that the old gauge should be maintained.

"Many attempts have been made to depart from the standard gauge, but none has succeeded, although a wider gauge would clearly make for more comfortable travel and greater speeds. The Great Western Railway adopted a gauge of 7 feet over all the important parts of its system, and it was in use for many years. But not a yard remains. It may, in fact, be said that the Roman soldier stepped out the railways of the world," concludes the article.

It should be noted that a gauge of 5 ft. 6 in. is in use in Argentine, Ceylon, Chile, India, Portugal and Spain. One of 5 ft. 3 in. is found in Australia, Brazil, Ireland and Russia. A 5 ft. gauge is in use in China, Cuba, Finland, Panama and Russia, according to the *Locomotive Cyclopedia*.

While this may seem to conflict with the statement made on page 53 of *The Bulletin* of April 1st, it should be noted that this reads "the gauge adopted for the Russian Railways was the largest and heaviest in the world." As this refers to conditions existing in 1834 or shortly thereafter, it may be reconciled with the contents of the above paragraph.

The meter gauge, 39.37 inches, is widely used where French or German engineers have laid out the roads. A gauge of 3 ft. is used to some extent in the United States, Central and South America, Hawaii and Ireland. For industrial and plantation operations gauges of 2 ft. 6 in. and even 2 ft. are in use, although the 3 ft 6 in. is the most commonly used of the narrow gauges.

First in the World!

(*Continued on page 73*)

Wheel Diameters, in.	
Engine Truck	33
Drivers	63
Tender, front truck	33
Aux. Locomotive	36
Journal Sizes, in.	
Engine Truck	7½ x 13
Drivers, except Main	11 x 14
Drivers, Main (Roller Bearings)	13 x 14
Tender,	6½ x 12
Ratios:	
Wt. on Drivers/Tractive Power, Simple	3.48
Wt. on Drivers/Tractive Power Compound	4.17
Total Evap, Heat. Surf./Cylinder Volume	576.76
Firebox Heat. Surf./Total Evap. Heat. Surf.	30.62
Total Firebox Heat. Surf./Grate Area	7.39
Grate Area/Cylinder Volume	13.06
Total Evap. Heat. Surf./Grate Area	44.21
Combined Heat. Surf./Grate Area	58.40
Rated Tractive Power/Evap. Heat. Surf., Simple	26.86
Rated Tractive Power/Evap. Heat. Surf., Compound	22.38

Note: Cylinder volume used in computations is **that** of the single high pressure cylinder.

Monkey Business

ALTHOUGH not introduced as such, a little item printed in *The Carnation* may, perhaps, be construed as supporting Darwin's theory concerning the descent of man from the monkeys. At any rate, here it is:

A certain professor, who spent almost his entire life studying the animals, told an interviewer once that monkeys would gather round a fire in the jungle and, by every means within their power, show that they truly enjoyed it. But never, by any chance, would one of them put a stick of wood on the blaze.

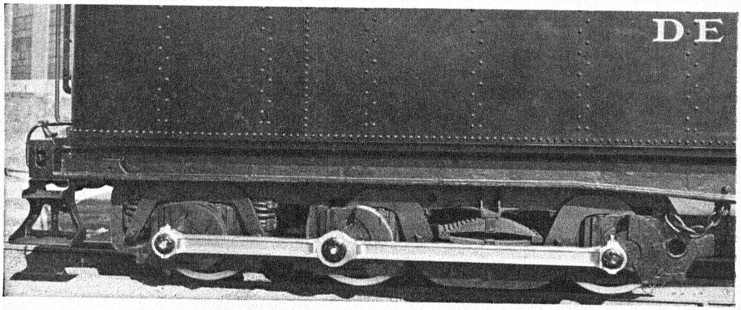
How true this is of a lot of people we know! They are glad to enjoy all the benefits that they can gather from someone else's work, but extremely careful to see that they, by no chance, exert themselves. They are great believers in cooperation and get a lot out of it as long as the other fellow does it.

Machines and Men

(*Continued from page 74*)

The machine must be paid, or paid for. There must be a return on the investment which often runs into hundreds of thousands of dollars.

We have had machines in industry for more than a century, gradually replacing men all the time. Yet, until very recently, they have all been absorbed elsewhere. So they will be again, as soon as the normal course of events can be resumed, at which time it is probable that every available locomotive will be needed.



Type of Auxiliary Locomotive used on the "L. F. Loree"

Clicks from the Rails

Where They Get Off

Why the cross-word puzzle fiends never found it is a mystery for which we are thankful. If the printer fails to divide it correctly in order to squeeze it into these short lines don't blame him, besides we refuse to believe anyone who says it isn't right. It's just the name of a little town in North Wales, Great Britain, spelled Llanfairpwllgwyngyllgogerychwyrndrobwllllandysiliogogoch. The source of our information claimed that this was a word of 58 letters so it looks as though a couple had gotten lost in transit, but there are enough left! When the trains approach the station the conductors point to the sign and say. "If there's anybody here for there—this is it." In plain English the name signifies: "Church of St. Mary in a hollow of white hazel, near to a rapid whirlpool and to the St. Tysilo's Church, near a red cave."

Averts Train Wreck

A 5-ton truck and trailer loaded with lumber and stalled on the Southern Pacific tracks near Turlock, Cal. at 4.30 A. M. with an east-bound train due, necessitated some fast work on the part of John Pirrello, Pullman employee. After building a fire between the rails to warn the engineer, he ran up the track toward the approaching train waving his flashlight and the train was stopped in time. Fifteen minutes later the stranded "highway-train" was hauled from the railroad track and the train proceeded.

Conductor Collects Violins

B. F. Boatright, of Shreveport, former K. C. S. brakeman and now a Pullman conductor, owns one of the largest violin collections in the Southwest. The 35 instruments are valued at $10,000 by their owner who has purchased them from individuals and pawnshops in the course of his travels.

Crawfish and Cat Tale

How a cat was used to pull in a new pipe to replace a broken culvert, and how a crawfish helped to clear the water out of the pit containing a set of track scales is told by B. & B. Foreman J. W. McIntosh of the Louisville and Nashville. When the scale pit filled with water, due to the drain pipe to a nearby creek plugging with mud, orders were given to dig up the pipe, clean it out, and re-lay it. Being as busy as most foremen, McIntosh tried the experiment of putting a large crawfish in one end of the pipe which was then sealed up. Two days later the fish had worked its way through the opposite end of the pipe and escaped. With a hose line the remaining mud was easily flushed out and a long job avoided. On another occasion it was proposed insert a 12-inch pipe in a fill to replace a broken stone box culvert, Catching a friendly looking cat, McIntosh tied a fishline to its tail and started it in one end of the broken culvert. Some difficulty was experienced in stopping the feline at the other end of the hole. A rope was then drawn through by means of which the pipe was drawn into place.

Save Life of Flagman

John Hammond, 80-year-old veteran Santa Fe crossing flagman of Pasadena, was knocked down by an automobile and held prisoner under it directly in the path of "The Chief," and owes his life to prompt action of two police officers who arrived most opportunely. One flagged the train with a flashlight while the other succeeded in releasing the injured man just as the train was brought to a stop 15 feet away. Yes, the motorist went to court.

Celebrates 70th Anniversary

For 70 years the "Royal Scot" has been running back and forth between London and Glasgow, 400 miles in 7 hrs. 40 min., having covered 17 million miles in that period.

First Head-on Collision

Ivan Nicholson, furloughed employe of the Canadian National, while studying up railroad history ran across the account of what is believed to be the first head-on collision in America between steam locomotives. It was on the Camden and Amboy, now part of the Pennsylvania, in 1836, that a lumber train and a passenger train came together with what the papers called a "tremendous crash," though no one was hurt beyond a few bruises.

Motorist Prefers Railroad

The London (Ontario) *Free Press* tells how a motorist, whose car skidded, went into the ditch and crashed against a stump, called a garage repair man and told him to take the car to his shop. He then handed him his driver's license and car registration certificate, declaring "I won't need them," and hailed a passing motorist for a ride to the railroad station. Trains will carry him after this.

Wins Carnegie Medal

Gardner Ritchie of the auditor of freight receipts' office on the B. & M. was awarded a Carnegie for quick action in saving a man's life. Standing directly on the tracks, the man failed to heed the approaching train or the warning cries of others. Comprehending that he must be deaf, Ritchie jumped across the track and carried him bodily to safety as the train roared past.

An Average Turnip

Agent T. L. Ward of the K. C. S. at Hatfield, Ark., submits as "just an average turnip" from his garden a specimen that measures 20¾ inches in circumference and approximately 6¾ inches in diameter.

The Man Inside

THERE'S a man inside of the man that you are,
And he's bigger than you, yes, bigger, by far,
And he's checking you up in every way,
And for each transgression he will make you pay.
And for each good deed he will pay to you,
A reward far above the price that is due,
So be good to him and respect this man,
Believe in his judgment, nor fear his ban.

There's a man inside of the man that you are;
If you listen to him you will travel far.
So listen and heed, don't be a fool;
Do what you do by the Golden Rule.
Build the man as you would a ship,
Sturdy and true for life's service trip,
And trust him well, he's your compass and guide,
And ever respond to the man inside.

—AUTHOR UNKNOWN.